REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a full and complete response to the Official Action dated April 4, 2007. In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due reconsideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Status of the Claims

Claims 1-23 are under consideration in this application. Applicants hereby submit that no new matter is being introduced into the application through the submission of this response.

Prior Art Rejection

Claims 1-23 were rejected under 35 U.S.C. §102(e) as being anticipated by US Pub. No. 2003/0212859 of Ellis et al. (hereinafter "Ellis") in view of a newly cited reference US 5,666,538 to DeNicola (hereinafter "DeNicola"). This rejection has been carefully considered, but is most respectfully traversed.

The disk array apparatus 10 of the invention (for example, the embodiment depicted in Figs. 1-2), as now recited in claim 1, connected to an information processing apparatus 20 so as to be able to communicate therewith, comprising: a plurality of hard disk drives 80; and a controller 13 (Fig. 3) constructed by including a host interface 40 which receives a request for a data read and request for a data write from/to said hard disk drives 80 from said information processing apparatus 20, a disk interface 50 connected to said hard disk drives 80 so as to be able to communicate therewith through a communication path which performs data input/output to/from said hard disk drives 80, a memory 15, a CPU 14 which controls said host interface 40, said disk interface 50, and a time counting mechanism 16. A logical volume 83 is formed in a RAID group 82 with disk drive redundancy made up of a plurality of said hard disk drives 80, said disk array apparatus 10 comprising: an access time storage section 201 which stores, upon reception of a request for a data read or request for a data write from/to said logical volume from said information processing apparatus 20, a time acquired from said time counting mechanism 16 as an access time in said memory 15 in association with an identifier of said RAID group 82 in which said logical volume 83 is formed; and a power saving mode execution section 202 which refers to said access time

stored in said memory 15 and sets a number of said hard disk drives 80 **according to the disk drive redundancy** of said RAID group 82 to a power saving mode when the difference between a current time (p. 17, line 28) acquired from said time counting mechanism 16 and said access time exceeds a certain time (e.g., a power saving wait time 302: 20 minutes in Fig. 3; p. 17, lines 10-19; p. 18, lines 1-5).

The invention as now recited in claim 8 is directed to the disk array apparatus of claim 1 having a plurality of first hard disk drives which perform data transmission/reception according to a first interface standard; a plurality of second hard disk drives which perform data transmission/reception according to a second interface standard having a shorter life than said first hard disk drives, and further including a power saving start time storage section 1303 (Fig. 13) which stores the second time acquired from said time counting mechanism as a power saving start time in said memory 15 in association with the identifier of said RAID group 82 when said first or second hard disk drives 80 are set to a power saving mode by said power saving mode execution section 203/1303; and a power saving mode cancellation section 205/1304 which refers to said power saving start time and cancels the power saving mode of said first or second hard disk drives in a power saving mode when the difference between said power saving start time and a third time acquired from said time counting mechanism 16 exceeds a certain time.

The invention as now recited in claim 20 is directed to a method implemented by the disk array apparatus of claim 8.

Claims 21-23 mirror claims 1, 8, 20 except replacing "a number of said (first) hard disk drives according to the redundancy of said RAID group to a power saving mode" with "a number of said (first) hard disk drives of said RAID group as less than a total number of (first) hard disk drives constituting said RAID group ("*a number of said hard disk drives less than the number of hard disk drives constituting said RAID group*" p. 18, line 25 to p. 19, line 5) to the power saving mode." When a RAID group includes at least one redundant disk drive, the number of the disk drives set to the power saving mode is less than the total number of disk drives included in the RAID group.

Applicants respectfully contend that none of the cited prior art references teach or suggest "a power saving mode execution section 202 which refers to said access time stored in said memory 15 and sets a number of said hard disk drives 80 ***according to the disk drive redundancy*** of said RAID group 82 to a power saving mode when the difference between a current time acquired from said time counting mechanism 16 and said access time exceeds a

certain time" as recited in claims 1, 8 and 20 or "a power saving mode execution section which refers to said access time stored in said memory and sets a number of said hard disk drives of said RAID group ***as less than a total number of said hard disk drives constituting said RAID group*** to a power saving mode when the difference between a current time acquired from said time counting mechanism and said access time exceeds a certain time" as recited in claims 21-23 of the present invention.

As admitted by the Examiner (p. 3, last paragraph of the outstanding Office Action), Ellis fails to teach such a power saving mode execution section. DeNicola was relied upon to provide the teachings. However, DeNicola only spins down inactive regular disk drives ("*for increased energy efficiency of the network server 110 by spinning down only the disk drives within the network server 110 for selected time intervals. ...the disk drives of the network server 110 can be spun down during periods of inactivity.*" Col. 4, lines 61-66; "*spinning the disk drives 240 down for periods where the disks 215 are not being accessed via the system*" col. 6, lines 30-32r), rather than inactive "redundant RAID" disk drives. DeNicola displays a histogram (e.g., Fig. 6A) to a network administrator for purposes of determining the activity of each of the regular disks within the disk subsystem 245 of the network server 110 (col. 7, lines 10-13). The histogram illustrates the statistical distribution of accesses for the disk subsystem 245 over a determined time period by representing the number of disk accesses for each time interval as a bar of varying lengths (col. 6, line 61 to col. 7, line 4).

Although DeNicola's disk power manager could easily be adapted for use with redundant arrays of inexpensive disks (RAIDs) (col. 13, lines 30-32), the combination of DeNicola's disk power manager with Ellis' RAID 0 storage system 300 will not provide the claimed invention as suggested by the Examiner.

The Examiner fails to establish a prima facie case of obviousness by properly bridging the proposed modification of the references necessary to arrive at the claimed subject matter. MPEP 706.02(j). There are numinous ways to combine DeNicola's disk power manager with Ellis' RAID 0 storage system 300. The most intuitive combination would be simply merge them as they are, rather than selecting bits and pieces from each reference, and then combining those bits and pieces using knowledge or hindsight gleaned from the disclosure of the present invention as a guide to support the combination. The well-established rule of law is that each prior art reference must be evaluated as an entirety, and that all of the prior art must be considered as a whole," *Panduit Corp. v. Dennison Mfg. Co.*, 227 USPQ 337, 344 (Fed. Cir. 1985). See *Para-Ordinance Mfg, Inc. v. SGS Importers Intl.*,

Inc., 73 F.3d 1085, 37 USPQ2d 1237 (Fed. Cir. 1995) ("Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor.").

As mentioned, Ellis' storage system 300 is designed mainly for RAID 0 ([0041]) which has only regular disk drives, but NO ***redundant*** disk drive. Therefore, Ellis cannot set a number of said hard disk drives 80 "***according to the disk drive redundancy*** of said RAID group 82" or "a number of said hard disk drives of said RAID group ***as less than a total number of said hard disk drives constituting said RAID group***" to a power saving mode as does the present invention.

RAID (Redundant Array of Inexpensive Disks) is a technique or a system storing replicated data in plural disks to improve fault tolerance. RAID 0 is the most primitive scheme. Each data is divided into plural portions (striping) and plural portions are stored into different plural disks (striped RAID 0). If data is not striped, it is stored into one of the plural disks (non-striped RAID 0). RAID 0 system has replicated data, but no redundant disk. Other RAID schemes, such as RAID 1 to RAID 6, have at least one redundant disk, into which replicated data is written. The replicated data is mirroring data, parity data, etc. Each scheme has advantages and disadvantages in access speed, fault tolerance capability and cost (p. 18, lines 6-19; p. 18, last 2 paragraphs).

Since there is no redundant disk drive in RAID 0, once Ellis sets the regular disk drives in a reduced power consumption mode, the reading/writing time (access speed) from/to the regular disk drives increases significantly, since it takes time to recover the regular disk drives from the reduced power consumption mode to a normal operation mode.

Even though Ellis allows "*simple computer systems to gain the advantages of RAID 0 (or higher) with little or no changes to existing implementations* ([0048])," merely by replacing "*a single ATA, SCSI or FireWire storage media with an array of storage media 311* ([0041])", or using "*more than one media controller 301*" ([0042]) of a higher RAID, or initiating "*storage media 311 to storage media 311 operation during initialization of a RAID 1 mirror pair* ([0053])", or coordinating "*the data paths from two or more media controllers 301 to give synchronized transfers and automatic data comparison for RAID 1, and generation or recovery of data for higher RAID modes* ([0057])," or configuring "*Host-side controller of 8 (bit field) for RAID 1 operation* (Table 1)," Ellis will not achieve what is offered by the present invention with a higher RAID system. Ellis sets a storage media 204 into a mode of reduced power consumption conditioned upon an instruction from a host or a timer that expires some seconds after the last host access ([0036]), but not "***according to the***

disk drive redundancy of said RAID group" or "setting only ***redundant*** disk drives of said RAID group" to a reduced power consumption mode as conditioned by the present invention.

As to DeNicola, it merely generally described that disk power manager could easily be adapted for use with redundant arrays of inexpensive disks (RAIDs) without providing any details, much less about "***according to the disk drive redundancy*** of said RAID group" or "setting only ***redundant*** disk drives of said RAID group" to a reduced power consumption mode as conditioned by the present invention.

Even if, arguendo, one skilled in the art were motivated to combine the teachings in DeNicola and Ellis as suggested by the Examiner, such combined teachings would still fall short in fully meeting the Applicants' claimed invention as set forth in claims 1, 8, and 19 since, as discussed, there are no teachings of "***according to the disk drive redundancy*** of said RAID group" or " "setting only ***redundant*** disk drives of said RAID group" to a reduced power consumption mode in either DeNicola or Ellis.

The present invention sets a number of hard disk drives set to the power saving mode either "*according to the disk drive redundancy* of said RAID group" or only the redundant disk drive(s) of said RAID group, when a certain time elapses after receiving the data read/write request (Fig. 4). The number of the redundant disk drives is a maximum number of the hard disk drives without which the data can still be correctly read (recovered) using the remaining hard disk drives (p. 19, lines 2-5). For example, in a RAID system including a group of four data disk drives and one parity disk drive, the data can be recovered from any of the four disk drives in the group. Accordingly, one disk is the redundant disk which can be set to the power saving mode according to the present invention. As such, the present invention can save power without significantly reducing access speed (p. 25, lines 11-21).

Applicants contend that Ellis fails to teach or suggest each and every feature of the present invention as recited in independent claims 1, 8, 20 and 21-23. As such, the present invention as now claimed is distinguishable and thereby allowable over the rejections raised in the Office Action. The withdrawal of the outstanding prior art rejections is in order, and is respectfully solicited.

Conclusion

In view of all the above, clear and distinct differences as discussed exist between the present invention and the prior art references upon which the rejections in the Office Action rely, Applicants respectfully contend that the prior art references cannot anticipate the present

invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicants' undersigned representative at the address and telephone number indicated below.

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